

BUREAU OF LAND MANAGEMENT SCIENCE STRATEGY



2008



BUREAU OF LAND MANAGEMENT
SCIENCE STRATEGY



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Contents

Forewordiv

Executive Summary v

Introduction 1

The Role of Science in the Bureau of Land Management3

Identifying the Bureau of Land Management’s Science Needs.....7

Communicating Science Needs and Sharing Results 10

Science Opportunities on the Public Lands 12

Implementation Concepts 14

Appendix. Identifying and Communicating the
Bureau of Land Management’s Science Needs 15



Foreword



Effectively managing our Nation's public lands requires the acquisition and application of accurate scientific information. This is increasingly important as we become more aware of the influences of human activities on the functioning of the natural systems that the Bureau of Land Management (BLM) has been entrusted with managing in the interest of the American public. This and other guidance require and enable the Bureau to respond to changing ecological conditions, to provide a wide variety of products and services, and to maintain the health of the public lands. In this era of rapidly expanding knowledge and methodologies of predicting future environmental changes, it is critical to keep up with the state of knowledge in resource management. By making use of the most up-to-date and accurate science and technology and working with scientific and technical experts of other organizations, we will be able to do the best job of managing the land for its environmental, scientific, social, and economic benefits. Our success in managing the public lands will ultimately be judged by the health and productivity of the public lands, the stewardship of their unique resources, and by the products and services received by the public who use them. We in the BLM are committed to using science to the maximum extent practicable and believe the process identified in this document will help us accomplish that goal.

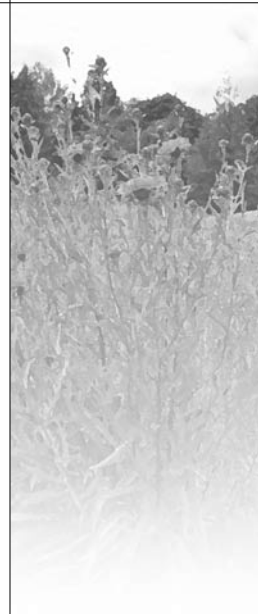
James Caswell
Director, Bureau of Land Management
September 2, 2008

Executive Summary

This strategy is an update of a document prepared in 2000 to assist in the application of science to Bureau of Land Management (BLM) natural resource management programs nationwide. It outlines a process for obtaining and using the most relevant, up-to-date science available.

The Federal Land Policy and Management Act of 1976 (FLPMA) Sec. 307 [43 U.S.C. 1737] (a) states, “The Secretary may conduct investigations, studies, and experiments, on his own initiative or in cooperation with others involving the management, protection, development, acquisition, and conveying of the public lands.” Moreover, in Sec. 202 [43 U.S.C. 1712] (c) (2), the BLM is instructed, in its Land Use Planning, to “use a systematic interdisciplinary approach to achieve integrated consideration of physical, biological, economic, and other sciences.” The National Environmental Policy Act also mandates a systematic, interdisciplinary approach to ensure an integrated use of natural and social sciences in planning and decision making. The Department of the Interior (DOI) Strategic Plan points out that we “have never had a greater need for accurate and timely science-based information than today,” and that “science lies at the foundation of our programs.”

This strategy discusses methods of identification of science needs from field office-specific to the use of the DOI’s Strategic Plan, and the prioritization of research and linkage to the budget process by the Science Committee. Science needs are addressed by Bureau field personnel and senior subject matter experts, as well as external research providers. The State science coordinators and the National Operations Center Division of Resource Services have roles in tracking funded research through to completion, including the synthesis of information and assurance that science information is integrated into program guidance and procedures. Although inventory, monitoring, and assessment applications are critical science activities that must be a part of any overall science program and will be part of the responsibility of the Science Committee, they are not addressed specifically in this strategy, as they are being developed through a separate effort.



Introduction

The Bureau of Land Management (BLM) Science Strategy sets forth an overall approach to science with four primary objectives:

- delineate the central role of science in BLM decision making and public land management;
- establish a clear process for identifying science needs and priorities and ensure that those needs are reflected in the Bureau's budget and planning processes;
- provide a mechanism for communicating the Bureau's science needs, sharing its science and results, and highlighting its science opportunities on the BLM-managed public lands; and
- ensure that the scientific information applied by the BLM in its management programs is current and meets the Department of the Interior's (DOI) requirements for quality, objectivity, utility, and integrity.

In addition to the efforts conducted by Bureau personnel, the Bureau seeks science information and support each year from external science providers both within and outside the Federal government. The Bureau also receives many requests from external science providers to communicate its science needs. Historically, the BLM has communicated these needs through individual programs rather than a single, coordinated Bureau-wide response.

The preparation of a BLM Science Strategy was proposed by the BLM Science Coordination Committee in Fiscal Year (FY) 1999. Committee members recognized the Bureau's need for a unified, comprehensive science strategy that would enable the Bureau to proactively identify, prioritize, and communicate its short-term and long-term science needs. The Committee reported its findings to the BLM's Executive Leadership Team (ELT), which subsequently approved preparation of a strategy document. The Strategy was signed by Director Fry and issued September 26, 2000. Recently, under the Managing for Excellence initiative, the ELT reaffirmed the importance of a Science Strategy.

Although science is central to the BLM resource management programs, this strategy clearly acknowledges that social and economic values, political factors, and statutory and regulatory requirements must be considered, along with scientific information, as the BLM managers make resource management decisions.

This updated strategy calls for the identification and prioritization of national and regional science needs. Identification of these science needs will begin with issues identified in the Department's long-range Strategic Plan. Input from the State and Field Offices through the Executive Leadership Team, the Science Committee, field managers, and resource specialists



will also play a key role. The early identification of the Bureau's science needs will allow those needs to be addressed in the Bureau's planning and budgeting activities.

The BLM's prioritization of science needs by the Science Committee is to be the primary tool for communicating the Bureau's needs and for ensuring that it acquires scientific information that is relevant, focused, and timely. Annual revisions and updates are scheduled to provide adequate lead time for the U.S. Geological Survey and the Bureau's other research providers to use the information in their own planning and budgeting processes for those needs that are to be met through outside sources.

"Science" within the Bureau is often mistakenly thought of only as research. Science may be in the form of data, synthesis or interpretation of data, resource inventories, assessments, resource monitoring, research reports and articles in credible publications, or research results from Bureau projects

or research providers. The BLM's definition of science encompasses social sciences as well as the earth (physical) sciences and biological sciences.

This strategy consists of five sections. The first discusses the role of science in the BLM; statutory and regulatory mandates are outlined, and the complex factors and interactions involved in decision making are described. The second section sets forth a process for identifying the BLM's science needs. The third section discusses how the BLM can communicate its science needs to science providers and share scientific research or study results both internally and externally. The fourth section describes the many opportunities for scientific activities on the BLM's more than 255 million surface acres of public lands, and the fifth section suggests an approach for implementing this strategy. The Science Strategy will be augmented by an implementation plan that will describe procedures for putting the approved strategy into action.

The Role of Science in the Bureau of Land Management

Science plays an important role in BLM resource planning and management decision making of both surface and subsurface resources. The BLM managers use science, as well as other information and considerations, in a management process that allows decisions to better fit on-the-ground conditions, current social and political scenarios, and available management options.

Science is defined in Merriam-Webster's Collegiate Dictionary as "the observation, identification, description, experimental investigation, and theoretical explanation of natural phenomena." Science should represent an objective, unbiased investigation into a subject. The collection and analysis of scientific data can be used to evaluate alternative hypotheses about the causes or consequences of observed conditions. As part of the scientific process, scientists obtain, analyze, and interpret information that, in turn, can be used to understand the potential consequences of management decisions. Further, scientific evaluation can determine if the management practices implemented were successful in moving toward or achieving the desired objective.

Statutory and Regulatory Requirements

Science provides the information that the BLM needs to meet various legislative and regulatory requirements. The National Environmental Policy Act of 1969 (NEPA) states that "...a systematic, interdisciplinary approach which will insure the integrated use of the natural and social sciences" shall, to the fullest extent possible, be utilized in planning and decision making that may have an impact on man's environment (Sec.102(a)). The Federal Land Policy and Management Act of 1976 (FLPMA) often refers to science and implies the need for scientific data to adequately implement the intent of the statute. FLPMA states that "...a systematic interdisciplinary approach to achieve integrated consideration of physical, biological, economic, and other sciences..." shall be used in developing and revising land use plans (Sec.202(c)(2)). Each of these mandates implies the use of credible information and a scientific basis for making judgments, comparisons, and analyses. FLPMA also states that "...investigations, studies, and experiment...in cooperation with others, involving the management, protection, development, acquisition, and conveying of the public lands may be conducted (Sec. 307(a))." The Data Quality Act of 2001 (Sec. 515, P.L. 106-554) requires Federal agencies to ensure and maximize "the quality, objectivity, utility, and integrity of information (including statistical information) disseminated." The DOI Strategic Plan for 2007 to 2012 states that science is the foundation for the Department's four mission areas of resource protection, resource use, recreation, and serving communities.



The Context for Science in Land Management Decision Making

Biological, physical, economic, and social science information is needed by the BLM to support its compliance with statutory mandates and regulatory requirements and to enable the BLM to implement sound management actions. Although science needs are often determined by specific issues and existing circumstances, science should also be used proactively to help identify future BLM management goals and needs for surface and subsurface resources.

Science is useful for evaluating alternatives and estimating outcomes. However, it is not the sole factor in making decisions because the state of natural resource science is often insufficient to give definitive cause-and-effect predictions. Unknowns and uncertainties will frequently be associated with predictions of decision outcomes. Science may reduce—but can seldom completely eliminate—the uncertainty regarding future events. However, the use of the best-available science—along with a consideration of political, social, and economic information—will result in the best-informed decisions. Specifically, science can do the following:

- Provide basic information for management decision making
- Help identify management goals and needs, and determine if they are being met
- Identify and evaluate alternatives and estimate outcomes

- Reduce uncertainty about events and the consequences of management actions

However, science cannot be relied on to:

- Eliminate uncertainties altogether
- Give definite cause-and-effect predictions
- Tell managers what they ought to do

Time and Scale Considerations

This Science Strategy provides the Bureau with the opportunity to address immediate science needs at the practical level, as well as to proactively develop scientific information at the strategic level. If the time for decision making is short (less than 1 year), an approach may need to be taken that relies on readily available science. As the time is lengthened, the ability to acquire more detailed scientific information increases. Lead times of 2 to 5 years or longer may be necessary for planning and conducting research, acquiring data, or performing inventories.

This strategy also provides a means of addressing science needs at different spatial scales. The type of information needed at the national scale is far different from that needed at the regional or local level. National issues normally require information that is general and possibly a synthesis of more detailed information from many sources. Regional and local issues, on the other hand, normally require more site-specific information and more detailed biological, physical, social, and political input.

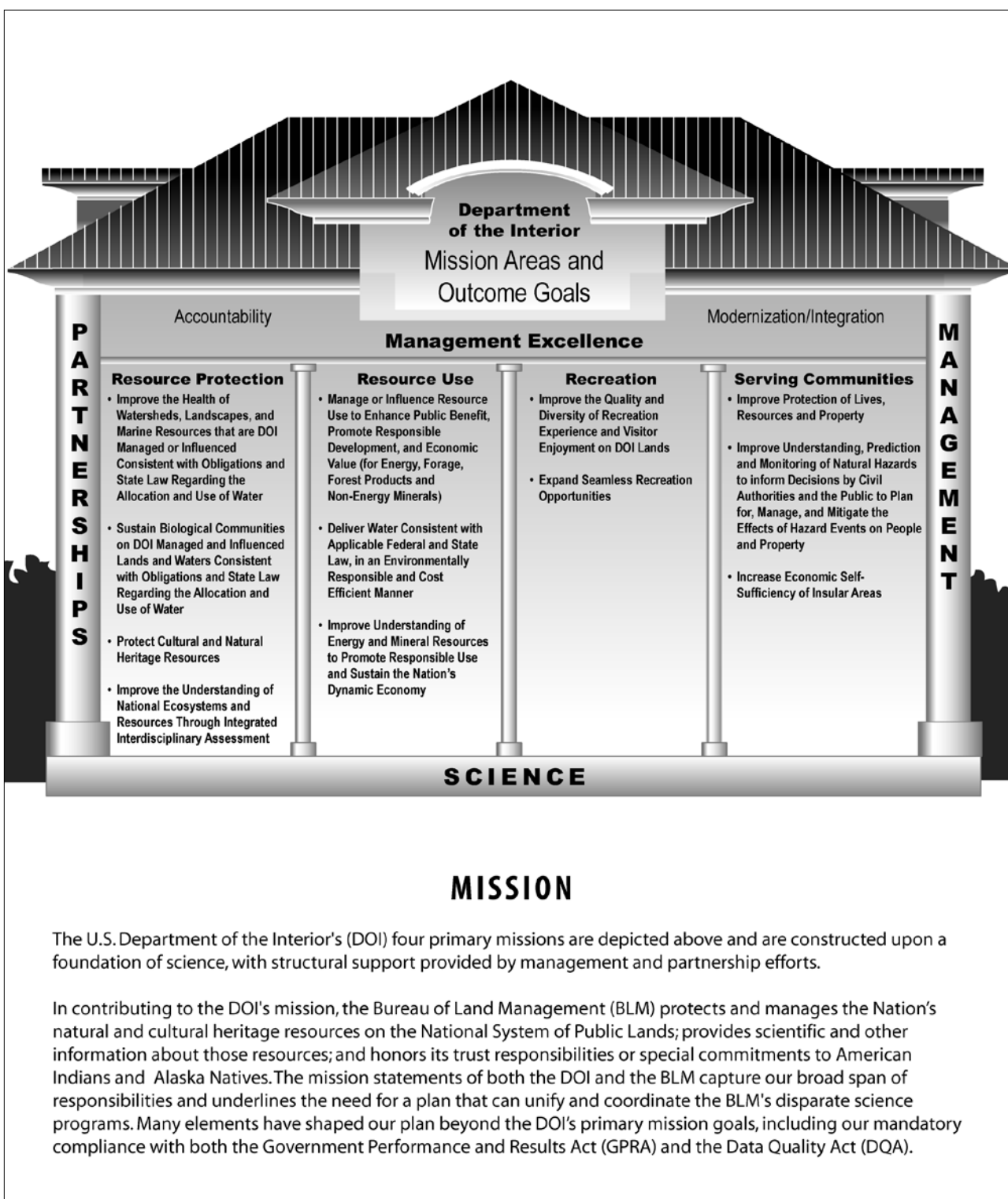


Figure 1. Mission statement, goals, and program activities of the Bureau.

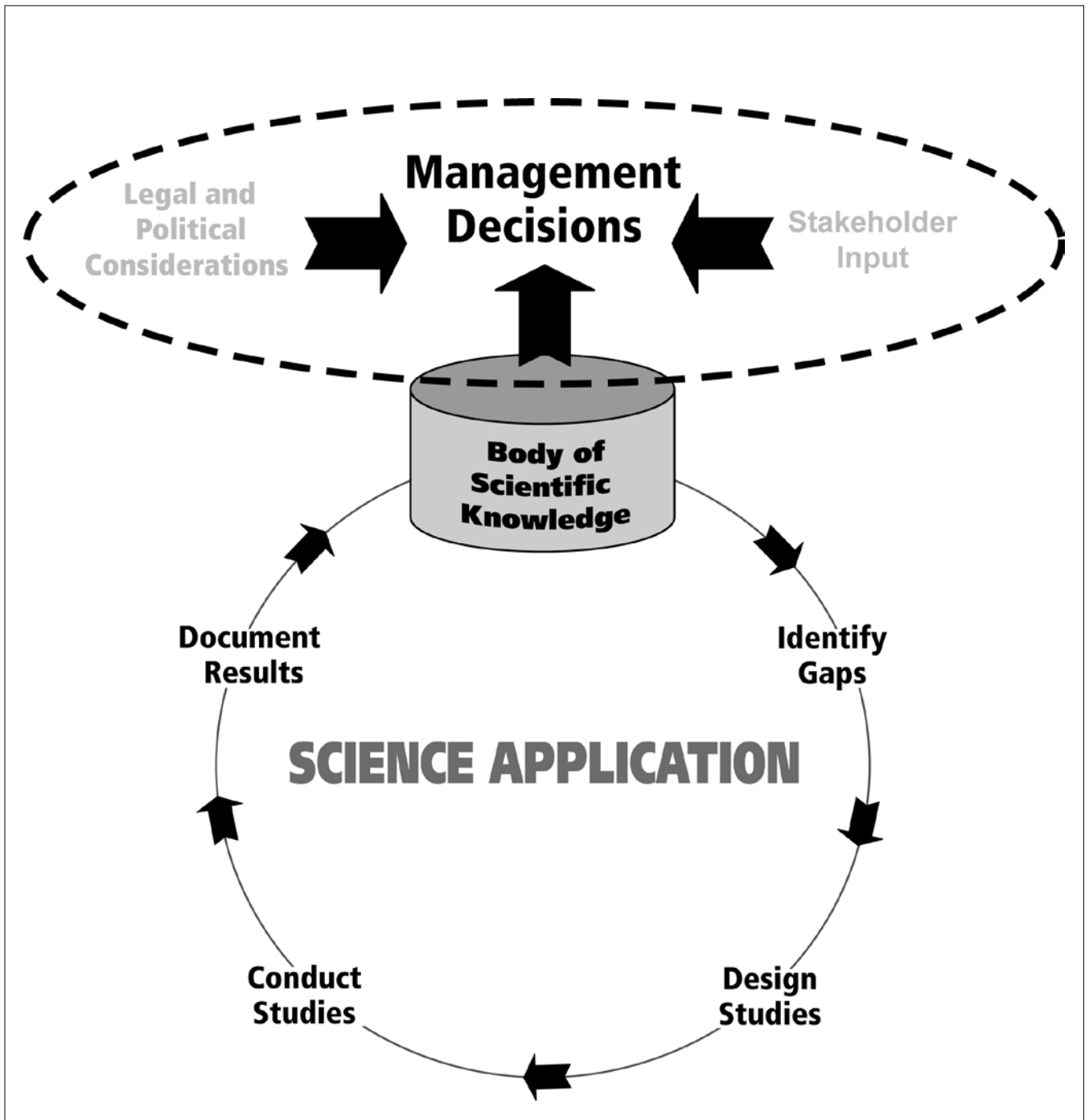


Figure 2. Science and decision making in BLM

Identifying the Bureau of Land Management's Science Needs

The BLM's national-level science needs, both proactive and reactive, will be identified through a sequential, issue-driven process that begins with the Department's Strategic Plan objectives and the Bureau's Operations Plan, which is nationwide in scope and identifies end outcome performance measures that support the Departmental objectives to the regional and local levels (Appendix). National resource management issues will first be derived from overall strategic mission goals in the Plan, and then expressed in a Bureau context. For example, the national management issue of Resource Protection will be focused on specific issues such

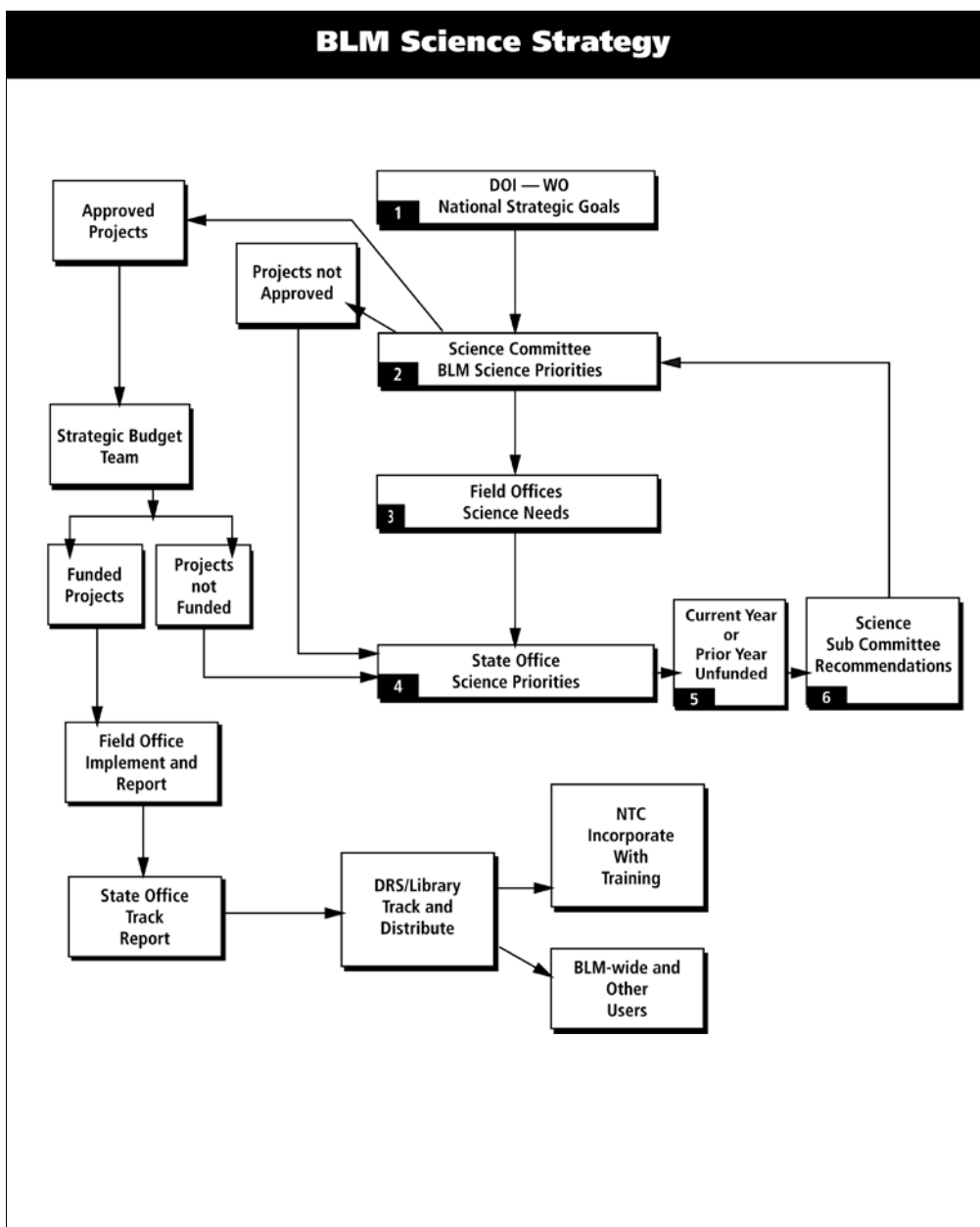


Figure 3. BLM's Science Process.

as invasive weeds, which will be further focused on the invasive weed species that are specific to each region. Issues will be identified and included from all levels of the Bureau through a continuous process in which information flows freely—that is, both “top down” and “bottom up”—between the Headquarters, the National Operations Center, and State and Field Offices. Coordination must also be ensured between identification of the general science needs of the Bureau and those of focused programs that have been established to address specific requirements, such as the Joint Fire Science Program and the Southern Nevada Agency Partnership science program. The State science coordinators and science coordinators of the focused programs, working as an advisory group to the Science Committee, will assist in aggregating and eliminating duplication in proposals for submission to the Committee for consideration for approval. The science needs will then be reviewed by the Committee, and those proposals within identified priorities and funding capability will be approved.

Priorities for general science needs, which can include resource inventories, various spatial and nonspatial data sets, and resource monitoring studies, will also be set by the Science Committee. Most of these needs will be accomplished by Bureau staff; however, in some instances, the BLM will look to other providers, particularly where the necessary information is already available.

In some instances, a local or regional issue may be significant enough to be elevated to the national level,

even though it might not be specifically referred to in the BLM’s Operations Plan. Such issues will be identified as national-level concerns. As the BLM’s research needs are compiled by the State science coordinators, they will be identified as national, regional, or local research needs. The Science Committee will communicate the Bureau’s resource management research needs internally and to national research providers.

More detailed information on identifying the BLM’s science needs is presented in the Appendix.

Biogeophysical Regions

Biogeophysical regions will be used to identify management issues and science needs, as well as support regional analysis for the BLM resource management and restoration and mitigation initiatives and other efforts. Biogeographic regions are not meant to be rigid or inviolate, nor must they be delineated to incorporate all resource values within a given region. They are simply a means of identifying and grouping management issues and science needs in a way that is understandable and logical and that allows the BLM to address issues and needs in an appropriate way. These regions also provide a geographical context for framing management issues and a means of grouping science needs and conducting resource evaluations and comparisons over time. This will be helpful in identifying partners, research providers, and interested parties for current issues.

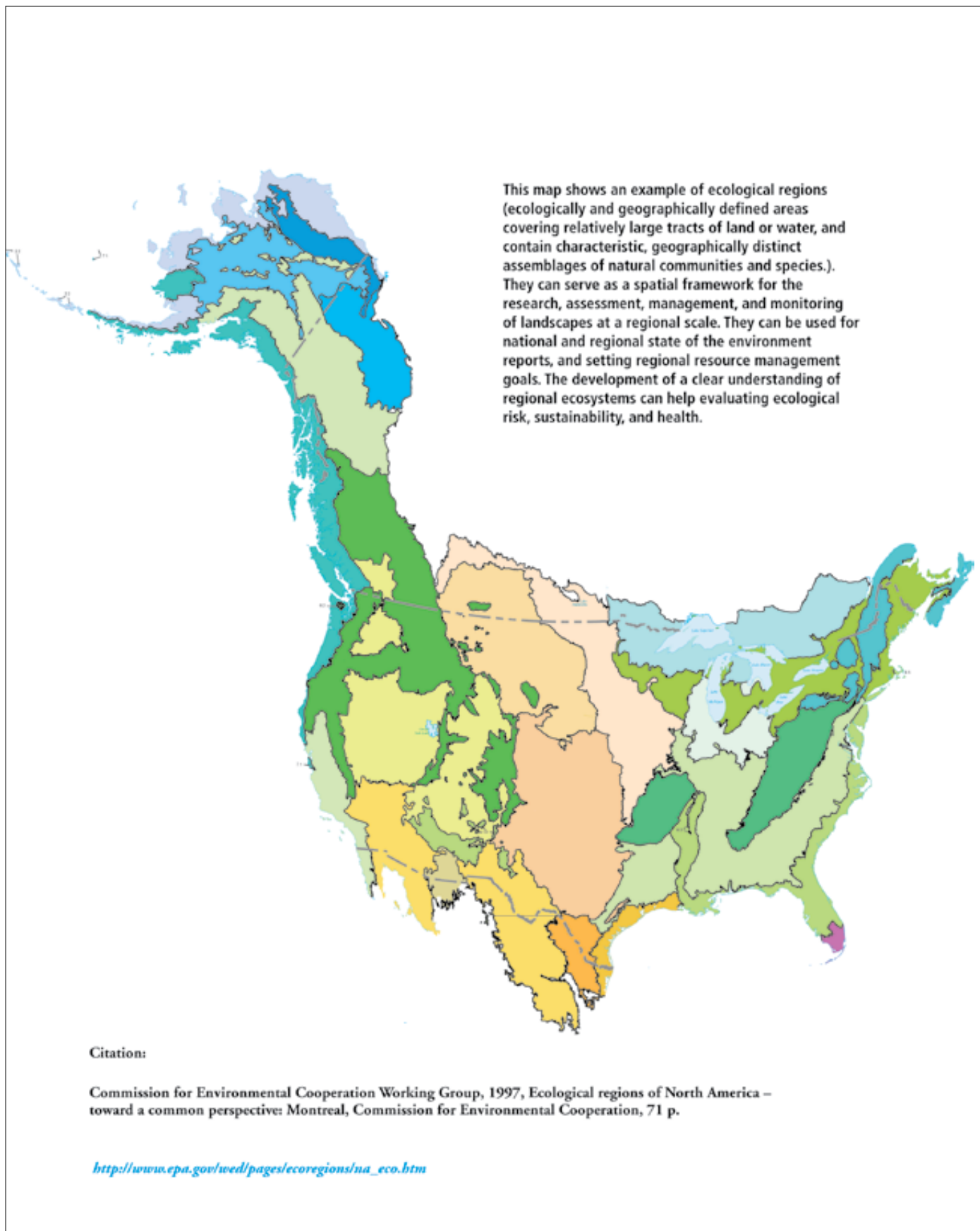



Figure 4. Ecological regions as an example for organizing science issues and needs.

Communicating Science Needs and Sharing Results



Although the majority of the BLM's science needs are accomplished by the Bureau's resource staffs, communication and feedback are key requirements in the Bureau's efforts to identify and prioritize the BLM's science needs and to ensure that science results and information are applied to land management activities and decisions. The Bureau needs to communicate two specific types of information:

- Management issues and science needs to decision makers and potential science providers, both internal and external
- Science results and information to all internal and external audiences that could benefit from this information

Communicating the BLM's Science Information Needs

The Bureau's science information needs must be communicated both proactively and in response to specific data calls and other requests for information. The U.S. Geological Survey is the designated research agency in the Department of the Interior, so it is a primary partner in addressing the BLM's science information needs. Other significant research providers include the U.S. Forest Service and the Agricultural Research Service, the National Science Foundation, multiagency institutes, and Cooperative Ecosystem Science Units (CESUs) and other academic institutions. Agencies and organizations that could be important partners include many other government and nongovernment agencies and organizations. Partners will be chosen on the basis of specific management issues or science needs being addressed and the ability of the proposed provider to address those needs.

Appropriate methods for communicating the BLM's science needs include meetings and workshops, written plans, the Internet (home pages, Web links to science projects, bulletin boards, and comment pages) and PowerPoint or similar presentations. In addition to these structured formats, the Bureau will encourage informal communications through telephone, e-mail, or face-to-face conversations with science providers and management partners to share information. Both formal and informal channels of communication will be kept open and encouraged to the maximum extent possible.

Important factors in developing and communicating science needs include the following:

- Geographic scale (local, regional, or national)
- Time scale (less than 1 year, 1 to 5 years, or greater than 5 years)

-
- Subject matter or mix of science needs (natural resources, cultural or social resources and context, and physical or abiotic resources)

The timing of communication efforts is critical. Science information will be communicated both as opportunities arise and according to defined schedules. The BLM will obtain detailed information on the planning and budgeting mechanisms for key divisions in the U.S. Geological Survey, U.S. Forest Service Research Stations, and other providers. Information will be communicated at both the national and regional levels to these provider organizations to coincide with their work planning and budgeting processes.

Lead times for providing information will vary. Some calls for information from providers will incorporate enough lead time to prepare customized information packages. Other inquiries will require fast response times. In some instances, the Bureau will have to customize information presentations to address specific issues, audiences, or other situations.

Sharing Science Information, Research, and the Synthesis and Interpretation of Results

Science information, studies, research, and interpretations and analyses of results will be communicated to the BLM decision makers, resource specialists, the scientific community, and the general public in a concise, understandable, and usable format. The Bureau's Internet homepage will provide quick access to, and wide distribution of, the BLM's science needs, ongoing work, and research results.

Key BLM internal audiences include Washington Office program leads, the Executive Leadership Team,

the Field Committee, the Science Committee, State Office program leads and science coordinators, Field Offices, staff managers (e.g., budget), Resource Advisory Councils, resource specialists, environmental impact statement teams, planning teams, regional groups (e.g., the Colorado Plateau Group), special initiative teams (e.g., the Great Basin Restoration Group), the Northwest Forest Plan staff, the Division of Resource Services, the National Interagency Fire Center, and the National Training Center.

External national audiences include the National Research Council (under the National Academy of Sciences), the DOI Research and Development Council, the National Science Foundation, the U.S. Congress, the Office of Management and Budget, the Council on Environmental Quality, key user groups, environmental and conservation organizations, and others.

Federal partners with whom the BLM will share science information and results include the USDI National Park Service, the U.S. Fish and Wildlife Service, Bureau of Indian Affairs, and Bureau of Reclamation; the U.S. Forest Service and Natural Resource Conservation Service; the Environmental Protection Agency; the Department of Defense; and the Department of Energy. Key audiences at the State government level include fish and wildlife agencies in the States where the BLM has a presence, along with State geological surveys, land and water resource management agencies, and commissions. At the local level, the BLM must collaborate and share information with Counties, municipalities, and the general public.

Educational outreach is also important. The Bureau will share science results and information by developing and participating in educational programs designed for both adults and young learners.

Science Opportunities on the Public Lands



The more than 255 million surface acres of BLM-managed public lands provide a vast assortment of opportunities for scientific investigations and management. Specific opportunities include the units of the National Landscape Conservation System, the BLM's research natural areas (RNAs), and other designated science areas, as well as undesignated public lands.

The National Landscape Conservation System

The BLM has established the National Landscape Conservation System (NLCS) to help protect some of the Nation's most remarkable and rugged landscapes. The system—which includes the agency's national monuments, Congressionally designated national conservation areas, and other areas designated for important scientific and ecological characteristics—ensures that future generations can enjoy some of the last, great open spaces in the United States. NLCS lands will enable the public to experience the solitude and splendor of these undeveloped landscapes by providing numerous opportunities for exploration and discovery.

Many of these areas were created, at least in part, to preserve extraordinary scientific resources and landscapes. NLCS lands contain significant geological, paleontological, archaeological, biological, and historical features. With their often unique resources and values, as well as their similarities to many surrounding areas, NLCS lands represent valuable open, natural laboratories. They will be managed to encourage collaborative science efforts, resulting in potentially significant advancements in natural resource knowledge.

Included in the NLCS are the following types of lands:

- National monuments—about 3.4 million acres
- National conservation areas—about 12.3 million acres
- Wilderness areas and wilderness study areas—about 22.5 million acres
- Wild and scenic rivers, national historic trails, and national scenic trails—about 6,200 miles
- A variety of specific or unique designations (e.g., outstanding natural areas, forest reserves, and cooperative management areas)

Research Natural Areas

Research Natural Areas (RNAs) are maintained as natural areas; only low-impact research activities are allowed. RNAs contain important ecological and scientific values and are managed for minimal human disturbance. They are used primarily for nondestructive

sampling, nonmanipulative research, and baseline data gathering on relatively unaltered communities. They make excellent controls, allowing the establishment of baseline conditions for similar natural communities that are being actively managed. RNAs provide a network of diverse habitat types preserved in a natural state.

Research natural areas are administratively designated and do not require the approval of Congress. The BLM has designated about 150 RNAs, mostly through its Area of Critical Environmental Concern process.

Other Designated Areas for Scientific Knowledge Management and Studies

The BLM occasionally designates research or study areas, often to accommodate the needs of researchers for scientific information on which to base management policy and decisions. Resource values to promote long-term ecological studies, monitoring, and assessment are often integral parts of the purpose of the designation. Multiple bureaus often work together to acquire ecological, social, economic, and cultural knowledge and apply that knowledge to managing public resources. Collaboration among the

public, scientists, educators, and land managers to attain common objectives and goals is very important. This process helps to promote an understanding of complex ecological processes and enables the development of ways to meet the needs of people while maintaining ecological viability. The BLM can authorize the designation of study or research areas. Areas designated can be used for either low-impact or high-impact studies. Special-use permits and land use plan amendments may be required for high-impact experimentation, but usually the designation alone would not require any changes to the BLM land use plan. Regulatory control will be in accordance with applicable sections of the Code of Federal Regulations (CFR), Title 43.

Scientific Use of Public Lands

Within the BLM's mission and the applicable management plans, these studies will be encouraged and the Bureau will collaborate with the investigators. The BLM will investigate and develop a protocol system for scientific or use registration. This protocol system will be reviewed by Field Offices to accommodate local, State, regional, or national needs and will be subject to any required approvals.

Implementation Concepts



The implementation of this strategy is intended to include as many disciplines and Bureau partners as possible. It is important that the process function in a timely way, in a logical sequence of steps, so the entire process moves smoothly; for example, information and new science needs must be available to feed into the budget cycle of the BLM and providers at the most opportune times. Additionally, implementation should not be a burden or impose undue workload demands on those individuals and offices involved in the process and needing the science information. It is important to note that not all steps must be completed for the next step to occur. Since this is a dynamic process, new information will continually be surfacing.

In implementing this strategy, it is our intent to identify and secure the priority science needs of the various offices of the Bureau, within the limitations of budget and staffing capabilities. The Bureau will take maximum advantage of partnering with other agencies and entities to leverage the BLM funding in situations where common objectives are shared and the Bureau's goals and objectivity are not compromised. Implementing this Strategy will involve, to the maximum extent possible, people and offices that are already functioning in related roles and activities. This is intended to take advantage of existing knowledge and experience without creating another level of bureaucracy or undue additional workloads, responsibilities, or personnel demands. The BLM's Division of Resource Services will be available to lead or assist national and regional teams as needed, and will have a participatory role in securing the appropriate expertise, tracking research accomplishments, synthesizing and integrating information, and ensuring that the results are made available and incorporated into Bureau programs. This will include working closely with the National Training Center and course instructors to ensure that new material appropriate for our programs are incorporated into BLM training courses.

Identifying and Communicating the Bureau of Land Management's Science and Research Needs

The following narrative describes the process for identifying and communicating the Bureau of Land Management's (BLM) science and research needs. It describes each step of the process and provides an example by showing how invasive weeds would be traced through the process.

Science Process Step 1. Evaluate Departmental Strategic Plan

Actions to be Taken. The Strategic Plan has been written to address the Department's strategic goals and to comply with the requirements of the Government Performance and Results Act (GPRA). Identify research and science priorities.

Responsibility. The Director, Executive Leadership Team, Headquarters program leads, and Field personnel.

Science Process Step 2. Identify National Management Issues

Actions to be Taken. National management issues will be derived from the background information that was used to develop the Bureau work plan priorities, along with additional information input from Headquarters personnel.

EXAMPLE: Invasive weeds have become a nationwide problem; in some areas, native species are being replaced by the invaders. Populations of valuable range, pasture, special status, and other plant species are being crowded out or reduced in productivity and value because of these invasions.

Responsibility. Headquarters managers and staff will express the Bureau's strategic goals as national management issues. This effort will be led by the national science coordinator with assistance from the Assistant Director, Renewable Resources and Planning (WO-200); Assistant Director, Fire and Aviation (NIFC); Assistant Director, Minerals, Realty, and Resource Protection (WO-300); and Assistant Director, Office of National Landscape Conservation Systems (WO-170) staffs. They will be assisted by the Division of Resource Services (DRS), State science coordinators, and those staff who were instrumental in developing the strategic goals.

Science Process Step 3. Express National Management Issues in a Regional Context

Actions to be Taken. National management issues will be focused to reflect how they apply to the various biogeographic regions of the United States. The BLM identifies and prioritizes the science needs and problems that threaten the targets and goals from the National Strategy. Targets are established for managing specific goals or objectives. Examples of national issues include: ecological forecasting for improving, protecting, and managing healthy lands; water management; fire management; carbon management; energy resources management; human health; and air quality.

EXAMPLE: Two very important invasive species in the central and northern Great Plains region are leafy spurge (*Euphorbia esula* L.) and Russian olive (*Elaeagnus angustifolia* L.). Both spread very rapidly, competing with native vegetation and reducing the productivity and value of range, pasture, and wildlife habitat.

Responsibility. National management issues will be framed in a regional context for each region. The most important regional management issues will be prioritized.

Science Process Step 4A. Define the Science Needed to Address the Regional Management Issues

Actions to Be Taken. The science needed to address the regional management issues will be defined. Science may include existing resource inventory, monitoring, and other data, as well as new information derived from research and project efforts.

EXAMPLES:

- ~ How do land management practices and development affect the opening of niches in the native vegetation to allow the invasion of the two species of concern?

- ~ What are the biological attributes of the invasive species that allow them to invade and out-compete the native species?
- ~ What biological characteristics may be used to exploit weaknesses in the life cycle for control of the species?
- ~ After various control measures have been used to reduce the invasive populations, what revegetation and management practices should be used to stimulate growth and production of desirable vegetation?

Responsibility. Science coordinators from the States within the region, along with the DRS and State and Field Office technical staff, will compose a core team for determining the science needs for each issue. With the cooperation of partners—that is, other land management agencies with lands adjacent to the BLM with similar problems—the team will determine the research or projects needed to address regional management issues.

Science Process Step 4B. Define the Science Needed to Address the National Management Issues

Actions to Be Taken. Science needs for national management issues requiring a national approach will be defined and addressed, similar to Step 4A above.

EXAMPLES:

- ~ At what rate are weeds spreading, and where are some of the more extensive invasive weed problems?
- ~ Where and how can we best respond to minimize damage and further spread?

Responsibility. The Science Committee will determine the science needs for each of the national management issues. It will be assisted by the science

coordinators and technical specialists from the appropriate staffs in Washington and in the field.

Science Process Step 5. Ascertain Current Science Information and Identify Additional Science Needed

Actions to be Taken. Current science information and science projects for each management issue will be identified and assessed to avoid duplication of effort and determine information gaps that need to be filled. The outcome will be a list of the additional science needed to fully address management issues. Any short-term tactical science needs that are identified during this process should be segregated and forwarded to the DRS to determine if there is a way to address these needs outside of the formal process. Input will be provided at this step from the BLM's science coordinators, program leaders, subject matter experts, and persons from the Division of Resource Services, the National Training Center, and the National Interagency Fire Center, and others. Regional science coordinators will play a major role in synthesizing the science information and needs. They will also help develop the plans and strategies that can be implemented. This will include project tracking in BLM's financial system from both a national and regional context.

EXAMPLES:

- ~ What is the "state of the science" related to the leafy spurge and Russian olive invading vast acreages, particularly along riparian zones?
- ~ What information is available and needed to determine the competition mechanisms or habitat conditions that allow or stimulate the invasion?
- ~ What information is available or needed to identify the mechanisms of the plants' biology and natural predators or consumers of the plants that may help deter further invasions?

Responsibility. The State science coordinators and various technical staffs will determine the current body of science relating to each regional management issue and the additional science needed to support decision making and implementation.

Science Process Step 6. Conduct Research and Share Results

Actions to be Taken. Research will be conducted, information and data gathered, and the results shared with the BLM managers and staff; information will also be made available to the public and any specific groups or individuals needing or requesting the information. Interpretation and translation may be required for highly technical information so that it can be understood and applied by resource specialists, managers, and others. The Division of Resource Services and Science Coordinators will help match needed science and projects to appropriate outside providers. They will help develop statements of work and provide oversight as contracting officers to the projects, followed by monitoring and assessing the actions to be taken.

EXAMPLE: Interpret and translate technical research results related to leafy spurge and Russian olive invasions in riparian zones into more useable information that specialists and managers can readily assimilate and incorporate into the management of riparian areas.

Responsibility. The BLM project coordinator and the research provider, along with the DRS staff, will develop an information transfer plan as a deliverable for each initiative. These plans, which need not be cumbersome, will identify the intended audiences for the information, what methods will be used to communicate the results, and who will be responsible

for the information transfer. The NOC Division of Business services will be responsible for incorporating a project coding system in the Financial and Business Management System to allow the tracking of funded research projects from funding approval through completion, in coordination with program offices.

Science Process Step 7. Apply Science to Land Management

Actions to be Taken. Science results will be used in land management activities and decisions. The Bureau will provide feedback to science providers, both at the regional and national levels, on how the BLM has applied the science they provided. This will enable the BLM and its science providers to evaluate the effectiveness and appropriateness of providers' contributions and will allow the BLM managers to modify decisions and management practices where needed. Science coordinators, land

use planners, subject matter experts, program leaders, and managers will work closely in identifying what science needs are missing and where information must be sought, including the levels of risks that could be taken. Finally, they all will review and modify the strategic targets, goals, and objectives, where needed—feeding back to Step 2 in the science process.

EXAMPLE: Incorporate science information on leafy spurge and Russian olive into Bureau policy and procedures, as well as on-the-ground management of riparian areas. Modify land use plans as necessary.

Responsibility. The BLM field managers and resource specialists will use the results of science investigations to address management issues and to sustain the health, diversity, and productivity of the public lands. The Regional Science Coordinators will be responsible for reporting on the success of the research support.

